Alaskan Way Viaduct
REPLACEMENT
PROGRAM

September 2012

Protecting structures along the SR 99 tunnel route

When the world's largest boring machine begins digging the SR 99 tunnel in summer 2013, it will mark the start of one of the largest earth excavation projects in the history of our state.

Approximately one million cubic yards of material will be removed, over a two-mile stretch, by the time tunnel construction is complete. While the ground naturally experiences movement over time, digging underground can cause additional movement.

We researched the soil's characteristics before establishing the tunnel route. Most of the tunneling will take place deep beneath downtown Seattle in terrain that is very dense and stable. In fact, multiple tunnels in the region have been successfully excavated in similar conditions.

Settlement monitoring program

While we do not anticipate significant levels of settlement, as a precaution, we are implementing a comprehensive program to assess, monitor and mitigate any effects of tunneling. We will track measurements of soil removal from inside the tunnel, evaluate any movement below ground, and assess any changes to infrastructure above and near the tunnel route, including buildings, utilities and roadways.

WSDOT established a construction monitoring area based on a building's distance from the tunnel. Within this area we are conducting pre-construction surveys to document the existing condition of buildings' interior and exterior areas. Crews will also install monitoring equipment to measure building movement during tunnel construction. Equipment will be installed on buildings and structures outside the monitoring area to provide additional reference data.

If damage does occur to buildings or streets as a result of tunnel construction, WSDOT will be responsible for costs associated with repairs. We will rely heavily on pre-construction surveys and monitoring data to evaluate the extent of construction-related damages.

Crews are assembling the machine now in Japan.

U.S. Department of Transportation Federal Highway Administration
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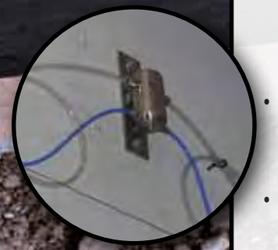
Monitoring Equipment

Monitoring points
- Size: Ranges from 6-by-6-inch prism to as small as a nail head.
- Continuously read by automated survey machines mounted on each block, or by manned survey equipment.
- Several monitoring points will be installed on building exteriors.

Ground monitoring instruments
- Size: 4 to 12 inches in diameter.
- Installed 2 to 300 feet underground in public right of way (streets and sidewalks) and covered with caps that resemble small manhole covers.
- Measures movement deep underground.
- Most electronically transmit data to project team; however, some require manual readings.

Crack gauge
- Size: Approximately 1 inch by 6 inches.
- Attaches to building with epoxy.
- Measures existing building cracks and any changes.

Automated survey machine
- Size: Approximately 1 foot by 6 inches, plus brackets or stand.
- Attaches to building roof or exterior.
- Continuously scans monitoring points to detect movement. Immediately transmits data to project team. Operates silently.



Liquid level sensor
- Size: A half-inch diameter tube filled with water that feeds into a 6-by-3-inch device that measures water level.
- Mounts on an interior wall, usually in basements, with bolts and brackets.
- Electronically transmits data to project team.

Tiltmeter
- Size: 3-by-12-inch device.
- Fastens to an interior wall, generally in basements, with bolts or brackets.
- Electronically transmits data to project team.

Monitoring plan features

Building monitoring: We will outfit nearly 200 buildings along the tunnel route with equipment to assess movement. Most buildings will have monitoring points installed on the exterior, but a limited number may require equipment on the inside, typically in the basement. Data will be collected around-the-clock. If any changes are detected, project staff will be alerted immediately.

Ground monitoring: More than 700 underground monitoring instruments will be installed in the streets and sidewalks along the tunnel route. These instruments will track any movement below the surface during tunneling.

Equipment installation, maintenance and removal: We will coordinate with property owners for installation and removal of monitoring equipment. During tunneling, some maintenance and readings may require that we have periodic access to the monitoring equipment. After tunneling, all buildings, streets and sidewalks will have equipment removed and be restored to their original condition. Installation of equipment and restoration on historic buildings will be consistent with federal and local preservation standards.

Timeframe: Installation of monitoring equipment began in spring 2012. It will continue in multiple phases until mid-2013. We will collect six months of baseline data of naturally-occurring earth movement before tunneling begins. We will continue collecting readings for about six months after tunneling is complete to ensure there is no delayed movement, after which the equipment will be removed.

What other tools will be used to monitor settlement?

Information from the tunnel boring machine (TBM)

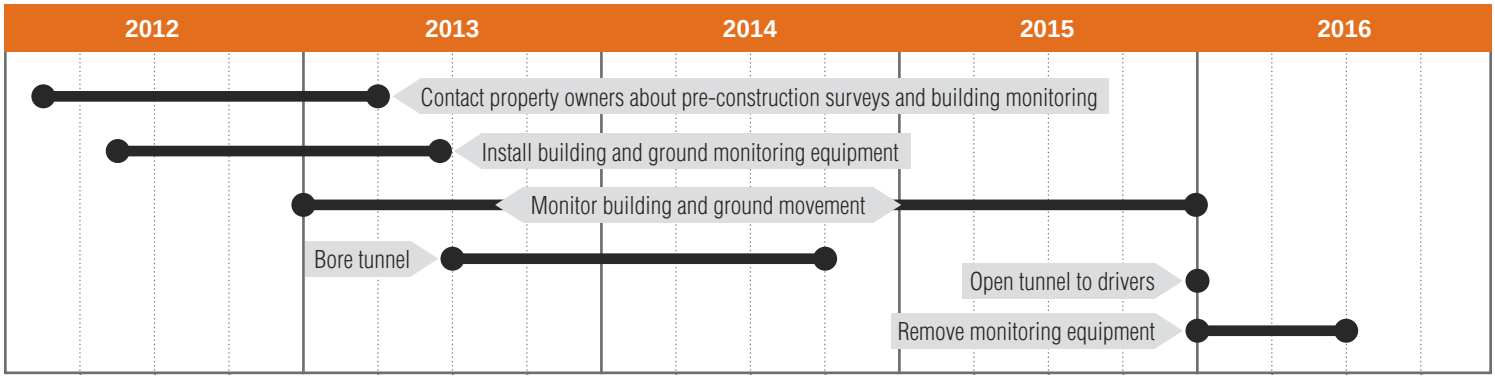
Once tunneling begins, it's estimated the TBM will advance an average of 35 feet per day. It will take approximately 10 days to pass underneath one city block. To ensure unstable voids aren't created underground, the TBM will be monitored in real-time. Inch-by-inch progress data will be collected and analyzed by dozens of monitors on the TBM, and the team will closely measure the amount of material excavated from the tunnel.

Satellite imaging

To provide a comprehensive view of buildings and structures along the tunnel route, we will use satellite imaging to collect data. Satellite images taken prior to tunnel construction will create reference points for our engineers. Throughout construction, we'll use satellite imaging to assess the condition of the ground. This technology will allow for precise, real-time topographic measurements and analysis of any movement, and will enhance information gathered by monitoring devices on buildings and in the ground.

Inside the control room of a TBM.

Timeline



For more information

Visit the website at www.AlaskanWayViaduct.org

Call the hotline at 1-888-AWV-LINE

Send an email to viaduct@wsdot.wa.gov

Send a letter to:
Alaskan Way Viaduct Replacement Program
Washington State Department of Transportation
999 Third Ave., Suite 2424
Seattle, WA 98104

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